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## Author Affiliation:

Department of Animal Production, Faculty of Agriculture Engineering, Tishreen University, Lattakia, Syria

## Corresponding Author

Department of Animal Production, Faculty of Agriculture Engineering, Tishreen University, Lattakia, Syria  
Email: [berkom1981j@gmail.com](mailto:berkom1981j@gmail.com)

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# First study of using the random music in the artificial incubators to evaluating some hatching parameters and behavioral performance of the Syrian local hens

Berna Krikor Jilenkerian\*

## ABSTRACT

This research experiment was conducted in the broiler laboratory in the Department of Animal Production, Faculty of Agricultural Engineering, Tishreen University, Lattakia Governorate, Syria. During the period of 2023. The aim of this study was to investigate the effect of exposing fertile eggs of the Syrian local hens to random music in artificial hatcheries. Total of (180) eggs were randomly distributed into tow treatment (90) eggs each treatment and were replicated three times with (30) eggs per replication, using the completely randomized design (CRD). The first treatment (T1) was exposed to a random music program for (12) hours, and the second treatment was the control (T0) without music. The results showed that a statistically significant ( $p < 0.05$ ) were observed among the tow treatment, the averages of the hatchability (%) for the music treatment (T1) were (90.87) % and the control (T0) (83.53) %, as for the hatching time (481.6, 490.7) h respectively. And for the live body weights on the 1st and the 7th day were (T1) (37.56, 117.89) g and (T0) (35.76, 105.66) g respectively. Using the music system (12) hours a day have positive role, it contributed to stimulating embryonic growth and increase the hatchability %, and synchronization of the hatching process for the entire batch. Also increased the averages live body weight of the chicks, and improved the quality and performance of newly hatched chicks, as it reduced the chicks' fear stress factor, and improved the birds' adaptation and acclimatization to the new environment after hatching.

**Keywords:** Local Hen, Random Music, Hatchability (%), Hatching Time, Body weight, Stress, Artificial Incubation, Behavioral Performance.

## 1. INTRODUCTION

Broiler for its nutritional properties differs from other kinds of meat, and this was recommended for diet and nutrition in different age groups, children, medical and dietetics nutrition and its meats in total meat of the world occupy the first place. In addition, there is a growing demand for broiler meat, in streets, stores, restaurants, hotels and bars and has been characterized as economically sustainable and highly productive. As well as increasing the need for more fertile eggs and increasing the hatching percentage of chicks from these eggs, and enhancing the importance of hatchability and quality of chicks in the field of the poultry industry. Many countries import broiler meat, because of the increased need for consumption of meat these were accordingly the intensive development of poultry industry. Chickens have consider as an excellent and cheap source of animal protein, and the body weight is important trait to birds breeders, and plays an important role in determining economic characteristics.

Moreover, the studies generally focus on improvement of the body weight to produce high quality meat during short periods (Tunsisa and Reda, 2023; Archer, 2016; Raji et al., 2008). The increase in feed costs and high consumption of the birds, and the accessible high price of broiler products as well as the increase in the price of other meats such as (beef, fish, turkey, duck), these encourage producing more chicken meat locally. Local hens occupy an important part of the rural economy in the world, because suitable for poor countries, especially in the rural areas where the resources are insufficient, and are a means of reducing poverty in rural communities because their labor and capital requirements are few compared to other livestock production projects (Reta, 2009). Also, in terms of generating employment opportunities and improving poor women especially in rural areas for ensuring household food security, because it requires little initial investment and that it does not usually conflict with women's other household duties (FAO, 2019).

Thus, the local hens contribute additional income (Assefa and Ewunetu, 2020; Sarkar, 2022). These chickens are hardy and provide a valuable protein source to rural households. Even though these chickens are resistant to disease, they are associated with low productivity. However, any improvement in the productivity of local chickens would require close attention to nutritional, breeding and health aspects (Manyelo et al., 2020). In addition, it contributes the nutritional needs of a large segment of society, because local hens have high productivity and hardy nature of the bird well as of the health benefits of its meat and resistance to harsh environmental conditions and the nutrition of local chickens depends mostly on the leftovers and waste of rural household foodstuffs. In addition, on what they pick up from nature during their wild rearing of substances rich in proteins and carotenoids (Sil et al., 2002). Which made the eggs of local chickens a nutritional substance rich in protein compared to the eggs of improved hybrid chickens raised in intensive rearing conditions.

In Kenya, local chickens contribute the production of the egg about 46 to 47% (Kingori et al., 2010a; Kingori et al., 2010b). In Malaysia, the contribution of local chicken productivity amounts to 70% of the hens farming, while in Bangladesh and Nigeria this percentage reached to 90% and 94% respectively (Aini, 1990). In nature, chicken embryos at different ages and species certainly receive some sound during incubation period. In addition, there is vocal communication between parents and embryos (Edgar et al., 2016). It was known that broiler embryos can detect and respond to external sounds from approximately the 16th day of embryonic development (Roy et al., 2014). Due to the sound considered as one of the most important external environmental factors in poultry management that influences on the egg and the meat production and behavior performance of the birds and has an important role in birds rearing (Schwean-Lardner et al., 2013). The artificial incubation considered the most essential period of the poultry intensive industry, this period is very important in the life cycle of chickens.

The incubation environment conditions (temperature, humidity, ventilation and egg turning) has a lasting effect on the health, production, behavior and welfare of birds throughout their lives. In addition, the high fertility of eggs and the maintenance of a suitable environment during this period have a major role in embryonic development (Archer, 2016). This factor has took attention in the poultry industry, that can be introduced during the incubation period to provide a natural environment for the artificial incubation to simulate the natural environmental factors related to the development of embryos and the development of the auditory systems in the embryos. Interest has also increased in studying the effect of the sound factor during the hatching of fertilized eggs for broiler chickens (Roy et al., 2014). Whilst many studies have been published dealing with the neurophysiological effects of sound exposure during incubation Sanyal et al., (2013a), Sanyal et al., (2013b), Roy et al., (2014), little effort has been made so far to understand the practical implications for the poultry industry.

Importance of the research and its objectives

The importance of this research stems from adding sound factor (music) during the fetal period in the incubator to obtain and improve the hatching process and the quality of the hatched chicks. The importance of music seems logical because, in an approach to the conditions of natural incubation. In view of absence studies concerned with the effect of the music on the development of the local hens embryos during the artificial incubator in the Syrian Arab Republic. The use of music technology as an additional environmental factor in in the artificial incubator was conducted for the first time in this study. This type of researches in present at the top of the list of research in the field of chickens health and environmental protection, in hens farms.

To benefit from its applications in the use of the application of a music system with high energy efficiency, which guarantees increased productive performance and enhances the health status of birds in economical ways and at the lowest possible cost, can be used safely with the presence of birds within the incubator. In addition, it is environmentally friendly and economical, and improving the internal environment of the hatcheries as it contributes to the development (Ojedapo et al., 2022) and growth of embryos, the speed and rate of hatching and the vitality of the chicks and reduces the mortality rate. The main aim of this study was to evaluate the effect of exposing fertile eggs of the Syrian local hens to the random music in the artificial incubator during the incubation period. With music period program (music 12: without music 12) on the hatchability (%), hatching time (h) and the live body weight (g) on the 1st and 7th day and behavior performance of the Syrian local hens to find new way to improve the health, production, behavior and welfare of birds throughout their lives.

2. RESEARCH MATERIALS AND METHODS

The experiment site

This study was conducted in the incubator of the broiler laboratory in the Department of Animal Production, Faculty of Agricultural Engineering, Tishreen University, Lattakia Governorate, Syria. During the period of 2023.

Experimental design and fertile eggs

A total of (180) one hundred and eighty fertile eggs from the Syrian local hens (45) wk –old, were collected in the same farm and were laid on the same day. The eggs weighed individually by a digital scale, the weight of the eggs ranged between (49-53) g, and the eggs were distributed equally in the incubation trays after disinfection procedures, with an average weight to tow different group (treatment), each group 90 eggs have three replicates with 30 eggs in each replicates using the Completely Randomized Design (CRD).

Incubation environment and programme of sound factor

Automatic artificial incubator made in Lattakia, Syria with a capacity of (1000) eggs was calibrated using a digital standard thermometer and hygrometer before incubation. With an electronic display remote controller was used to set up a standard incubation conditions such as temperature (°C), relative humidity (RH%) and egg turning were maintained equally as shown in the (Table 1). The incubator was provided with music player (MP3) and Bluetooth speaker (Mini Speaker® - BT51), with average sound power (12) watt, waterproof and dust resistant (IPX5). Music was turned on in the morning at (7:00) am and was turned off in the evening at (7:00) pm, were subjected to non-stop music for (12) hours during the experiment period 21 days. The music program (music 12: without music 12), the experiment treatments are as follow: treatment (T0) control (without music), treatment (T1) random music.

**Table 1** Standard incubation conditions temperature (°c), relative humidity (%), eggs turning during the incubation period fertile eggs of local hens

| Incubation Period/Day | Temperature (°C) | Relative Humidity (%) | Eggs Turning         |
|-----------------------|------------------|-----------------------|----------------------|
| 1-6                   | 38               | 60                    | Once every two hours |
| 7-12                  | 37.8             | 55                    | Once every two hours |
| 13-18                 | 37.6             | 60                    | Once every two hours |
| 19-21                 | 37.2             | 70                    | Stooped turning      |

## Measurements and studied traits

### *Percentage of hatchability (%) and hatching time (hour)*

After the complete end of incubation, the hatchability (%) was determined as the number of chicks hatched divided by the number of fertile eggs of the Syrian local fens using of the following formula, and the hatching time (h) was calculated when (50) % of the chicks hatched.

$$\text{Hatchability\%} = \frac{\text{Hatched chicks number}}{\text{Total fertile eggs number}} \times 100$$

### *Body weight of the hatched chicks and behavior performance*

After hatching was completed, all chicks were removed from the incubator at the end of the experiment, and were collected for each group (treatment) separately for all replicates. Then weighed randomly (20) chicks per replication at the 1-day-old and on the 7th day by a sensitive digital weighing scale with an accuracy of (0.01) g, the behavioral observation was did twice a day, in the morning at (7:00) am and in the evening at (5:00) pm during the period of one week after hatching.

### Statistical analysis

Data were subjected to analysis of variance (ANOVA) appropriate for a completely randomized design (CRD), with two factors, using the GenStat (v.12) program. Duncan's test shows the significant differences between studied traits at a significant level of 5% ( $P \leq 0.05$ ).

## 3. RESULTS AND DISCUSSION

### **Hatchability (%) and hatching time (hour)**

Figures 1, 2 shows results of the effect of using random music on the percentage of the hatchability % and the hatching time in each treatment during the incubation period. A significant increasing ( $p < 0.05$ ) was observed among the averages of the music treatment, compared to the control treatment. The averages of values for the percentage of the hatchability % was shown in the Figure 1 for the music treatment were (T1) (90.87) % and the control (T0) (83.53) %, and therefore the random music achieved (7.34) % more than the control treatment for the hatchability percentage. While the averages of the values of the hatching time (hour) at treatment (T1) took less hatching time and achieved at the music treatment (481.6) h, and in the compared treatment (T0) (490.7) h, and the averages of the hatching time for music treatment achieved (9.1) h less than the control treatment, as shown in (Figure 2).

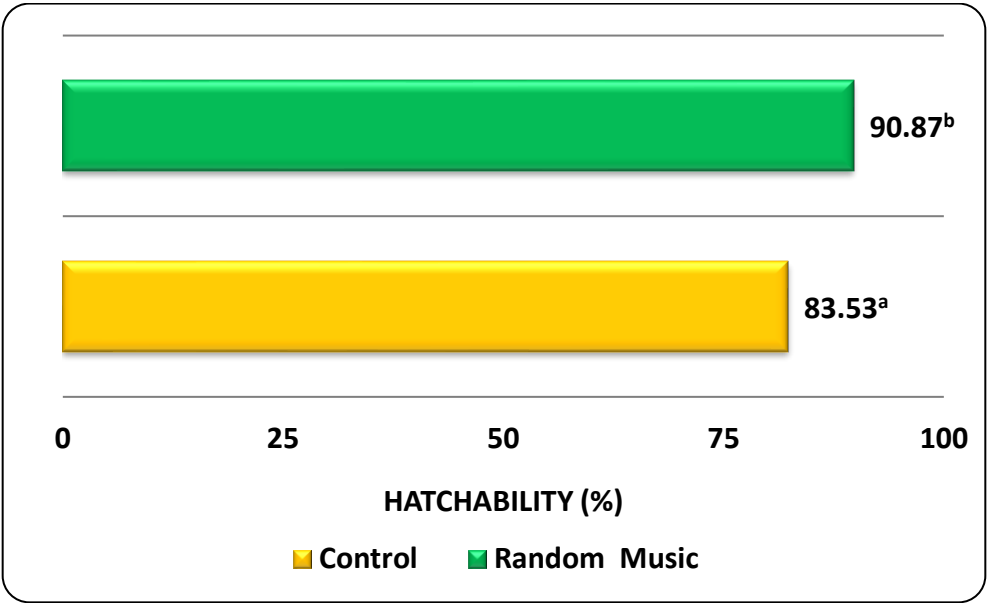


Figure 1 Effect of the random music on hatchability (%) of the Syrian local hens

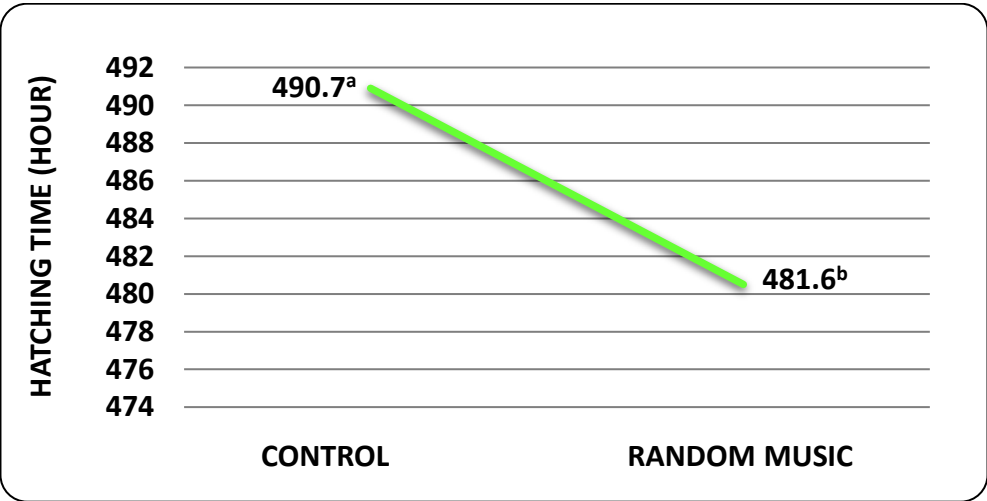
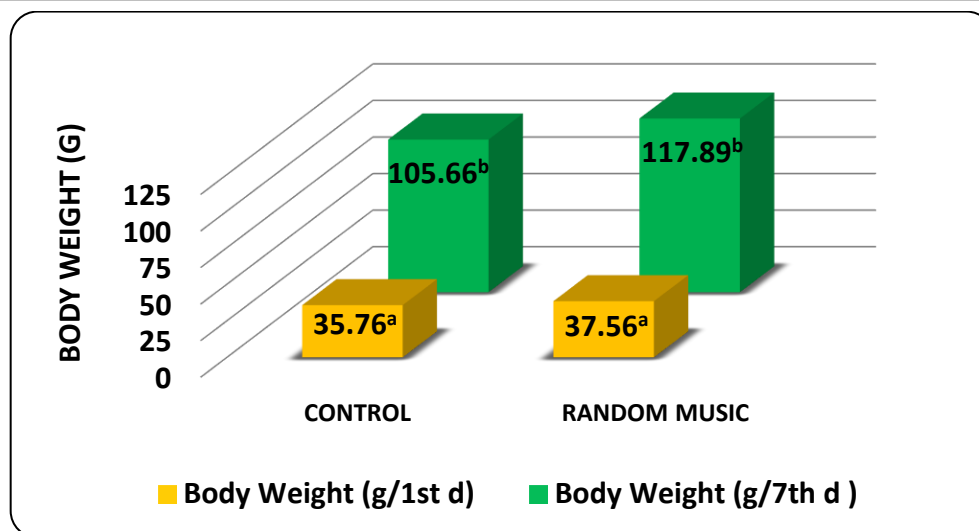


Figure 2 Effect of the random music on hatching time (hour) of the Syrian local hens

Body weight of the chicks and behavior performance

Figure 3 shows a significantly differences ( $p<0.05$ ) among the averages of the live body weight of the chicks, between the two studied treatment. The use of music during the incubation of eggs led to an increase in the weights of the chicks. And the highest values of the initial body weights were to the music treatment (T1) (37.56) g and the lowest values at the control treatment (T0) (35.76) g. While at the age of 7th day the values also achieved the highest weights at the treatment (T1) were (117.89) g compared to the treatment (T0) (105.66) g. The results shows that random music significantly produced heavier chicks than the control treatment. The random music achieved (1.8) g more than the control treatment on the 1st day, while on the 7th day of the hatching achieved (12.23) g more than the control treatment.



**Figure 3** Effect of the random music on body weight (g/1st and 7th d) of the Syrian local hens

## Discussion

### *Hatchability (%) and hatching time (hour)*

The results of the egg incubation process are evaluated upon the hatchability % traits. The hatchability % for the laying hens reaches to (95) % and for broiler (93). In the study conducted by on the Syrian local chickens in the coastal environment (Latakia), the hatchability % of the first generation first reached to (82.65) %, while the second generation second it reached to (83.44) %. In Egypt, this percentage were for Dokki-4 (64.2) %, Gimmizah (83.2) %, Mamourah (82.2) %, Sinai (77.7) % (Sherif et al., 2022). And in the Southern Ethiopia the hatchability percentages of Sasso and Koekoek chickens were (70.8) % and (69.7) %, respectively Assefa et al., (2023), and of the Sidama Region was (84.1) % Tunsisa and Reda, (2023) and with the study of Moges et al., (2010) was (81.7) %. And this percentage ranges between (80) % to (83.6) % for local hens in Tanzania (Msoffe, 2023; Mwalusanya et al., 2002).

While in Kenya ranged between (66) % to (73) % Kingori et al., (2010a) and from (77) % to (89) % according to Moreki et al., (2010), in Bangladesh, the hatchability was (87.9) % Zalal et al., (2023) and in another study was (87) % (Bhuiyan et al., 2005). All of these studies about the hatchability % were conducted without using the music during the egg incubation period, and we notice that our experiment birds were higher in the hatchability % when adding the music in the incubator. And increase the value of the hatchability % can contribute to improving the economic situation of breeders, as increasing the hatching rate by less than 1%, can contribute to significantly increasing revenues. This increase of the hatchability % for the incubated eggs in this study attributed to the use of the music (sound factor) in the incubator.

That can lead to an increase in the biochemical components in the blood plasma of developing embryos and thus an increase in metabolic activity due to hyperthyroidism, as the increase in metabolism is associated with an increase in the secretion of thyroid hormones, triiodothyronine (T3) and thyroxine (T4) and reduce stress. Which leads to stimulating the developmental and metabolic processes necessary for the success of the hatching process, including increasing the fetus's ability to switch to pulmonary breathing in the late embryonic stage, which leads to accelerating the hatching process. These results were in line with the study of which indicated that the embryonic mortality % decreased when fertilized eggs were exposed to the music, it also agreed with the study of Donofre et al., (2020), who observed a decrease in the duration of incubation in eggs exposed to music compared to eggs not exposed to it.

### *Body weight of the chicks and behavior performance*

It has known that random music has important role to enhance the bird's auditory and physical enrichment that increases tolerance to fear and stress of the birds, also increase the body weight and improve eating habit and lessens the aggression of the birds. Moreover, the auditory inputs like music have impacts on the body pulses like in brain waves, heart rate and breathing, and as known the body pulses related to the moods and habits, which affects the birds, feed intake. It appears from the observations of the behavioral performance there was a significant difference among the two treatments. Birds that were used in the control treatment (T0) were

suffering from stress and anxiety and that was reflected in their behavior. Because the sounds emanating from the external environment of nature attract attention and keep the birds in a state of constant alertness, which increases their stress and this was reflected in eating habit and in the consumption of feed, which leads to a lack of feed intake.

When the body activity rises, the energy consumption increases, and these led to decrease in the productive efficiency of birds. Moreover, it affected the body weight of the birds at the control treatment. In addition, they show the aggressive behaviour among the birds as pecking feathers. While the chicks in the treatment of the random (T1) music, showed a significant increase in terms of eating habit as feed intake and meal duration, and thus this was reflected in an increase in the body weight compared to the control treatment. It can be attributed to the positive effect of the music that the birds may possibly like to eat well. And the music results to regular eating and resting for a longer period of times without excessive movement which eventually lengthens the meal duration and more feed intake. The initial body weights of the the laying hens were (49) g at the first day after hatching, and at the age of 7th day (97) g respectively Senbeta and Balcha, (2020), and for broiler (43.6, 174.2) g respectively (Toader et al., 2018).

While for the local hens the live body weights for example in Egypt were for Dokki-4 (32.5, 75.5) g, Gimmizah (35.0, 78.9) g, Mamourah (35.7, 82) g and Sinai (34.4, 76.0) g respectively (Sherif et al., 2022). In Bangladesh for the Deshi chickens (29, 77) g respectively Bhuiyan et al., (2005), and in another studies the initial body weight was (52.3) g Zalat et al., (2023) and (45.97) g Desha et al., (2016), and in the Indonesia local hens were (30.21, 67.42) g respectively (Sutopo et al., 2021). All of these studies about the live body weights were conducted without using the music during the egg incubation period and when comparison these values with our results in this study we notice that our experiment birds were higher in the body weights. Also, the type of random music contributed lesser aggression among the chicks with significantly diminished agitation, improve moods and lower levels of stress, fatigue, tension, sadness and hostility, as well as increased the vigor.

Moreover, the music is one of the most important stress reducing factor among the birds. In addition, contribute the calm of the birds. Due to the music affect, the physiological and behavioral responses of the birds, and it gave good results during this experiment. Because it increase the neuronal numbers and density in the auditory cortex and hippocampus, a greater expression of synaptic proteins associated with the hearing development of domestic poultry and post-hatching behavioral changes (Sanyal et al., 2013a; Sanyal et al., 2013b; Roy et al., 2014). Expose the birds to the music helps to cover up the loud noises that result from the nature, and keeping them more relaxed in their environment, which helps them to comfortably to eat and increased trigger eating habits behaviour. And it is known that exposure with loud noises sound in the nature negatively affects the birds similarly to humans in terms of physiology, cognition, brain chemistry and behaviour this results similar to the results of.

#### 4. CONCLUSIONS

We are able to say that adding the music factor in the incubators according to the program system of music (12 music: 12 without music) during the incubation period of local hens eggs contributed to:

- Stimulating embryonic growth and development, and increase the hatchability % and improving overall hatching conditions and process.
- Shorten hatching time the duration of incubation and the synchronization the hatching process for the entire batch.
- Increase initial body weight at the 1st day of the chicks and at the age of the 7th day.
- Improved the quality, vitality and performance of newly hatched chicks, reducing fear response and stress of chicks after hatching, and helpful for chicks to adapt to the new environment after hatching giving them a better start to post-hatching development and improve behavioral performance.
- Reduced the noise (audio pollution) resulting from the incubation device, improved the surrounding environment of the incubator in the laboratory, and gave excellent psychological comfort to those responsible for supervising the hatching process.
- Finding new way to improve the health, production, behavior and welfare of birds throughout their lives and increasing productive performance and enhancing the health status of birds in economical ways and at the lowest possible cost compared to birds that were incubated without music. Which achieves great importance of economical and contributes to a significant increase in revenues in the hatchery and for chicken's breeders.



**Recommendations**

Base on the result of this study, we recommend to breeders exposing the fertile eggs of the different kinds of birds to random music to enhance the bird's auditory and physical enrichment that increases tolerance to fear and stress, also increase the body weight and improve eating habit and lessens the aggression of the birds. And repeat the application of the experiment in different types of music to determine the best music program in terms of the duration and optimal sound intensity.

**Author Contributions**

The author has contributed all elements of the paper.

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**Ethical approval**

The Animal ethical guidelines are followed in the study.

**Informed consent**

Not applicable.

**Conflicts of interests**

The authors declare that there are no conflicts of interests.

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**Data and materials availability**

All data associated with this study are present in the paper.

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